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(54) Multi-layer carpet tile assembly.

(57) A fabric-pile carpet construction comprises a facing layer comprising nylon, acrylic, polypropylene, or wool fibers secured to a bonding layer comprising a hot melt adhesive, a vinyl acetate-ethylene copolymer latex adhesive, or a polyvinylchloride (PVC) plastisol adhesive, and a different backing layer selected from the said bonding layer materials, and a chemical barrier comprising a polyester or fiberglass scrim impregnated with a vinyl acetate-ethylene copolymer latex adhesive located between the facing layer and the backing layer.

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This invention relates to the construction of fabric-pile carpet tiles or broadloom carpeting having two or more layers, including at least one hot-melt bonding layer.

The economic advantages and convenience of carpet tiles, as compared to traditional broadloom carpeting are well known, for instance from U.S. Patent 5,004,638, the disclosure of which is incorporated herein by reference. That patent also describes production and quality control problems of carpet tiles.

For example, a relatively heavy extrusion backing and adhesive layer arranged between the backing and primary carpet tile facing must supply most of the flexibility, weight and structural strength of conventional carpet tile. Not many conventional tile backing components however, are capable of satisfying all of these needs. Furthermore, production and environmental demands limit the choice of facing and backing combinations that can be used to bind carpet facing and backing layers under high speed production conditions.

The said '638 patent discloses a primary carpet facing component comprising tufted or untufted nylon, acrylic, polyester, polypropylene or wool fibers secured to a bonding layer comprising a hot melt adhesive, and preferably precoated with a latex or resin composition. It also discloses a backing component comprising a flexible base layer preferably consisting of a hot melt adhesive material, such as a combination of an ethylene/vinyl acetate copolymer and an aromatic or aliphatic hydrocarbon resin, and including one or more scrim layers between the base layer and the primary carpet facing component, the purpose of which is to provide additional weight and strength to the base component. The difficulties encountered in using a conventional polyvinylchoride (PVC) backing are mentioned, and the possible need to use a wide variety of different materials for the facing and backing components to meet the desired specifications for the product.

The various materials that may be used in the formulation of the components of the carpet structure are described in U.S. Patent 4,576,665, particularly with reference to non-tufted pile fabrics, and the problem of possible separation of layers during use. The well-known formulations and uses of hot melt adhesives and other conventional bonding compositions such as polyvinyl chloride plastisol (PVC) compositions are also described in the said '665 patent.

There is a need for a carpet tile structure that permits the use of different materials for precoatings and adhesives in the facing component, on the one hand, and for the backing component on the other. In particular, there is a need to provide means for blocking the migration of vinyl plasticizers in one or more of the layers to a hot melt adhesive layer, for instance, between PVC backings and conventional hot melt adhesive materials in the facing layers and or vice versa, thus avoiding the deleterious effect of such migration on adhesive strength and achieving a combination of maximum pile bind, abrasion resistance, and resistance to edge unraveling.

According to the invention, a fabric-pile carpet construction comprised of a tufted or non-tufted facing layer of nylon, acrylic, polypropylene, or wool fibers secured to a bonding layer selected from the group consisting of a hot melt adhesive and a polyvinylchloride (PVC) plastisol adhesive, and a different backing layer selected from the said group, is characterized in that a chemical barrier located between the facing layer and the backing layer that tends to block the migration of a vinyl plasticizer between and adhered to the bonding layer and the backing layer, the said barrier comprising a polyester or fiberglass scrim, preferably having a Frazer Air Permeability Value not over 137.2 $m^3/m^2/min$ (450 cubic ft./sq.ft./min.), and impregnated with a cross-linkable vinyl acetate-based latex adhesive, preferably a vinyl acetate-ethylene copolymer latex adhesive, that has an affinity for adhering to polyvinyl-chloride.

Because the barrier coated scrim adheres effectively to both hot melt adhesive layers and polyvinylchloride (PVC) plastisol adhesive layers, it effectively inhibits the migration of the vinyl plasticizers that are compatible with and tend to degrade hot melt adhesives.

Such use of the barrier coated scrim, consisting of a nonwoven polyester or fiberglass sheet impregnated with the vinyl acetate-ethylene copolymer latex adhesive, is particularly adapted for the intermediate, relatively heavy layers of carpet tiles, but it can also be adapted to broadloom applications. In either case, the layers separated by the scrim are various combinations, known to those skilled in the art, of conventional materials.

The barrier coated scrim can be comprised of a polyester or fiberglass scrim that has been coated with a vinyl ester-ethylene latex adhesive compound, preferably a vinyl acetate-ethylene latex. Any conventional polyester or fiberglass scrim may be used, but preferably it should have a Frazer Air Permeability value not over 137.2 $m^3/m^2/min$ because a larger mesh size may make it difficult to control the latex adhesive application, thus tending to increase the stiffness of the coated substrate. Most preferably, it should have a permeability value of about 400. Such a preferred polyester scrim is manufactured by Freudenberg Spun Web Co., Durham, North Carolina under the product designation LDH 7113. It has a Frazer Air Permeability value of 121.9 $m^3/m^2/min$ to 137.2 $m^3/m^2/min$ (400 to 450 cubic ft./sq./ft./min). A preferred fiberglass scrim is

manufactured by Schuller Mats & Reinforcements, a division of Schuller International Inc., Toledo, Ohio under the product designation R-8395. It has the same Frazer Air Permeability value as the above-mentioned polyester scrim.

Any cross-linkable vinyl acetate-based latex adhesive formulation, that can readily be determined to have an affinity for adhering to polyvinylchloride, may be used in order to provide a barrier for the migration of vinyl plasticizers between PVC backings and conventional hot melt adhesive materials in the facing layers and/or vice versa. It should not contain formaldehyde, and also should be sufficiently flexible when cross-linked to avoid contributing stiffness to the tile structure. The preferred barrier coating is a cross-linkable vinyl acetate-ethylene latex formulation that has excellent adhesion to polyvinylchloride as well as to the scrim material and hot-melt adhesive used.

The most preferred barrier material is available from Reichhold Chemicals, Inc., Research Triangle Park, North Carolina under the tradename Tylac® synthetic latex and under the product designation 99757-00.

The appropriate composition of the barrier latex coating can be identified by routine adhesive test evaluations of a limited number of available latex blends, and the desirable volume of the barrier latex coating can readily be determined for any specific application through routine testing, as required to prevent a harmful degree of vinyl plasticizer migration as reflected in the delamination strength. The exact formulations are normally proprietary information owned by the suppliers and the manufacturing techniques employed by the scrim manufacturers and the type and geometry of the fibers used are proprietary information owned by the suppliers, who are willing to prepare appropriate materials specifically to order if desired.

The facing layer of the carpet structure, normally comprising nylon, acrylic, polypropylene, or wool fibers, may be conventially tufted into a woven or nonwoven scrim, or secured by direct bond to the bonding layer. It may be preferable to apply a precoat to the fiber layers of the facing layer, which may be a hot melt precoat resin comprising an alkylaryl hydrocarbon resin or an aliphatic hydrocarbon resin, a vinyl acetate/ethylene copolymer latex adhesive, or a PVC plastisol precoat.

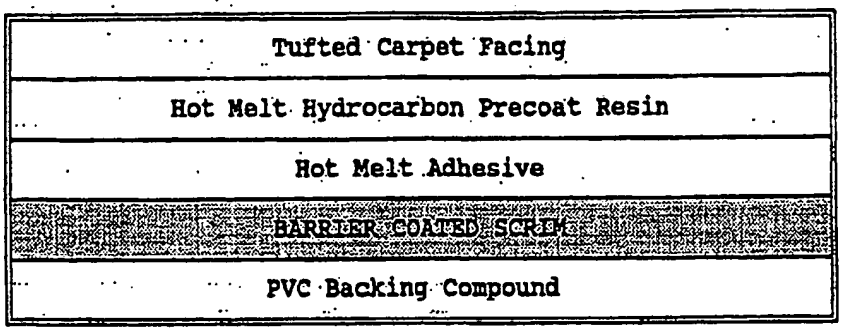
The hot melt adhesive compositions that may be used in the bonding layer include the wide range of conventional hot melt adhesives that have been available for many years. Typically such compositions may have a melt viscosity of less than about 200Pa s (200,000 cps), preferably less than about 100 Pa s at a 149°C (300°F) application temperature. Examples include, for instance, blends of ethylene-vinyl ester copolymers, petroleum waxes and thermo-plastic resins, as disclosed in U.S. Pat. No. 3,551,231, the disclosure of which is incorporated herein by reference. Most preferably such compositions have a melt viscosity of 10,000 to 15,000 cps. at the same application temperature.

Other blends may include ethylene-vinyl ester copolymers combined with low molecular weight, low density polyethylene microcrystalline waxes, and aromatic or aliphatic thermoplastic hydrocarbon resins. Preferably the combination includes ethylene-vinyl acetate and the alkaryl hydrocarbon resin available from Hercules Incorporated under the designation Piccovar® CB48 Resin. Conventional additives to improve heat resistance, flammability or surface abrasion are included as required. Suitable particulate fillers such as calcium carbonate are conventionally added. An alternative bonding material is PVC plastisol.

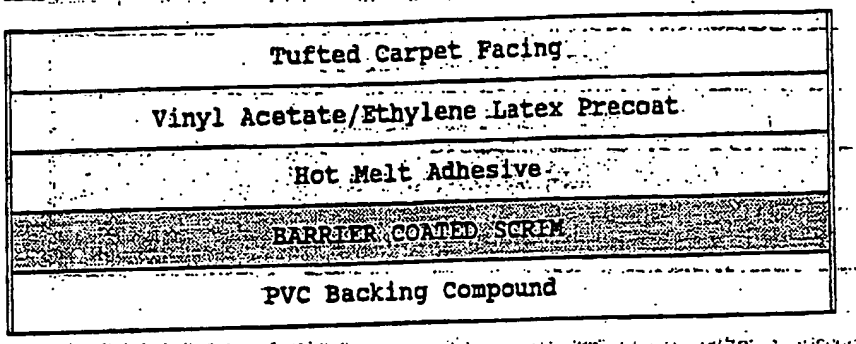
Preferably the backing layer comprises either a conventional PVC plastisol, including the appropriate plasticizers and fillers, or a conventional hot melt back-coating compound, preferably the above-mentioned resin designated as Piccovar® CB48 Resin. The volume of PVC coating is defined by the manufacturers internal product specifications. An alternative backing material is PVC foam.

The optional combinations of layers that can be used with the barrier layer according to the invention are as follows:

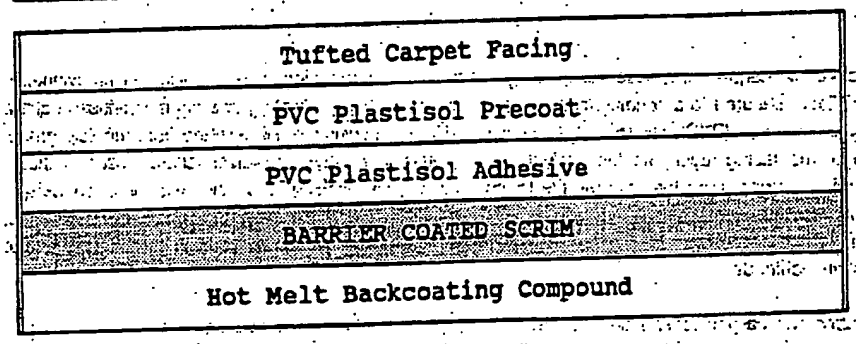
OPTION 1


Tufted Carpet Facing
Hot Melt Hydrocarbon Precoat Resin
Hot Melt Adhesive
BARRIER COATED SCRIM
PVC Backing Compound

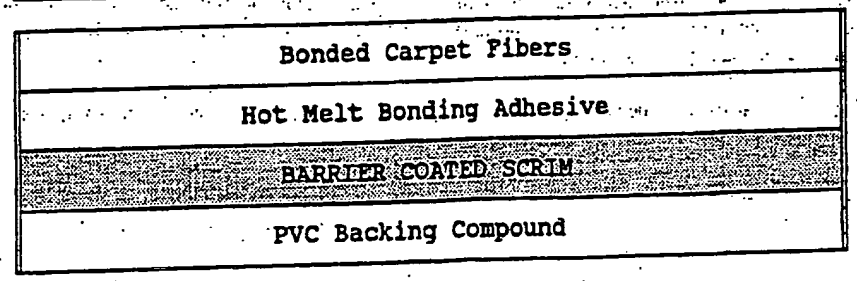
OPTION 2



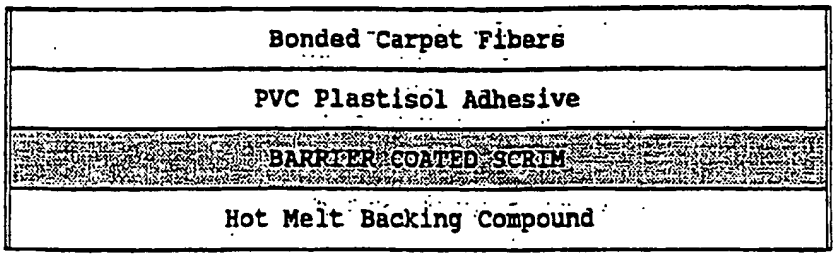
OPTION 3



OPTION 4



OPTION 5



Optionally, in addition to the barrier layer according to the invention, a woven fiberglass scrim having, for instance, conventional 6 x 6 or 2 x 3 weave construction, may be inserted between the bonding layer and the barrier layer to impart additional stability to the structure. Also optionally a woven scrim can be introduced into a hot melt or PVC backing layer if the type of carpet construction involved would benefit from such reinforcement.

Claims

1. A fabric-pile carpet construction comprising a facing layer comprising nylon, acrylic, polypropylene, or wool fibers secured to a bonding layer selected from the group consisting of a hot melt adhesive and a polyvinylchloride (PVC) plastisol adhesive, and a different backing layer selected from the said group, one of the facing layer and the backing layer containing a vinyl plasticizer, characterized in that a chemical barrier is located between the facing layer and the backing layer, the said barrier comprising a polyester or fiberglass scrim coated with a cross-linkable vinyl acetate-based latex adhesive, preferably a vinyl acetate-ethylene copolymer latex adhesive, that has an affinity for adhering to polyvinyl-chloride.

2. A fabric-pile carpet construction as claimed in claim 1, further characterized in that the scrim has a Frazer Air Permeability Value not over 137.2 $m^3/m^2/min$.

3. A fabric-pile carpet construction as claimed in claim 2, further characterized in that the scrim has a Frazer Air Permeability Value not over 121.2 $m^3/m^2/min$.

4. A fabric-pile carpet construction as claimed in claim 1, 2, or 3, further characterized in that the bonding layer comprises a hot melt adhesive composition comprising an ethylene-vinyl ester copolymer and an aromatic or aliphatic hydrocarbon resin.

5. A fabric-pile carpet construction as claimed in claim 4, further characterized in that the ethylene-vinyl ester copolymer is an ethylene-vinyl acetate copolymer.

6. A fabric-pile carpet construction as claimed in claim 4 or 5, further characterized in that the hot melt adhesive composition has a melt viscosity of less than about 100,000 cps at an application temperature of 149 °C.

7. A fabric-pile carpet construction as claimed in claim 6, further characterized in that the hot melt adhesive composition has a melt viscosity in the range of 10,000 cps to 15,000 cps at an application temperature of 300 °F.

8. A fabric-pile carpet construction as claimed in any of the preceding claims, further characterized in that the backing layer comprises a polyvinylchloride (PVC) plastisol.

9. A fabric-pile carpet construction as claimed in any of the preceding claims, further characterized in that the vinyl acetate-based latex adhesive is a vinyl acetate-ethylene copolymer latex adhesive.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 11 4913

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	EP-A-0 171 201 (NIPPON OIL CO. LTD.) * page 4, line 20 - page 7, line 23; claims; figures * * page 9, line 19 - page 11, line 14 *	1,4,5,8	D06N7/00
A	LU-A-65 498 (LES ETABLISSEMENTS MARECHAL S.A.) * page 2, line 20 - line 37; claims *	1,8	
A	WO-A-90 00967 (INTERFACE, INC.) * page 10, line 8 - page 13, line 19; claims; figures 5-7 *	1,8	
A	EP-A-0 176 346 (MILLIKEN RESEARCH CORPORATION) * the whole document *	1	
D,A	EP-A-0 297 611 (HERCULES INCORPORATED) * the whole document *	1,4,5	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

D06N
B32B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 January 1994	Pamies Olle, S

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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